IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Patent Application of	Confirmaiton No. 4372
BARTLETT	Atty. Ref.: 540-317
Serial No. 09/914,838	Group: 2674
Filed: September 25, 2001	Examiner: P. Prizio, Jr.
For: HEAD TRACKER SYSTEM	

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APPEAL BRIEF

On Appeal From Group Art Unit 2674

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April 7, 2005

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P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

I. REAL PARTY IN INTEREST

The real party in interest in the above-identified appeal is BAE SYSTEMS ELECTRONICS LIMITED by virtue of an Assignment of rights from the inventor to BAE SYSTEMS ELECTRONICS LIMITED recorded October 25, 2001 at Reel 12321, Frame 491.

II. RELATED APPEALS AND INTERFERENCES

There are believed to be no related appeals, interferences or judicial proceedings with respect to the present application and appeal.

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III. STATUS OF CLAIMS

Claims 1-17 stand rejected in the outstanding Official Action. The Examiner contends that, with respect to claims 1-17, the specification as filed fails to comply with the enablement requirement of 35 USC §112 (first paragraph) and that claims 1-17 are either anticipated or rendered obvious in view of the cited prior art.

IV. STATUS OF AMENDMENTS

No amendments to the claims have been submitted after receipt of the Final Rejection mailed August 6, 2004.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention relates to a method and apparatus for determining a user's head orientation relative to a datum position.

Head tracker systems are well known and operate to determine a user's head orientation and its position relative to a fixed datum. Such systems have been useful in military aviation and especially with the advent of helmet mounted displays in which symbology is displayed on the face shield of a pilot's helmet within his field of view. Such symbology can be created to move relative to the pilot's helmet so that the pilot perceives the symbology staying in the same place even though his head moves left or right, up or down, or in roll. A head tracker

system supplies the information concerning movement of the pilot's head and as such are generally well known. Such systems are useful in allowing a weapon aiming marker to be aligned over a target by movement of the pilot's head and the sensed movement providing accurate aiming information to the weapons system.

Prior art head tracker systems include optical sensors systems in which the helmet carries a number of light emitting diodes, whose position is detected by position sensitive detectors mounted in the vehicle cockpit. Similar magnetic sensor systems are known in which the relative magnetic field in the cockpit is sensed and thereby calculating the position of the helmet and thus the pilot's head within the helmet. Various inertial systems using gyroscopes and accelerometers have also been considered, and hybrid systems involving combinations of two or more of the above systems are known or have been proposed.

A present problem is that any head tracker system must have a fast dynamic response, as pilots' head movements are often extremely rapid. It is also important that the system be highly accurate and known systems either have a fast dynamic response or high accuracy, but generally not both.

Appellant found that the use of optical processing can provide both the required high dynamic response rate, as well as the high accuracy desired of modern head tracking systems.

In one embodiment of Appellant's invention, a head mounting (helmet 2) is attached to the user's head. An optical sensor (video camera 12) is mounted in a

known fixed relationship to the head mounting or helmet. A plurality of distinguishable markings (marking generators 18a-18j) are located in fixed relationship to a desired datum point. An optical correlator such as a Vander Lugt or joint transform type correlator is used for optically correlating an optical image from the video camera. The optical correlator has an optical image of at least one of the marking generators 18a-18j and correlates the optical image from the optical sensor 12.

A separate means for determining the orientation of the head mounting (processor 28) is responsive to an output from the optical correlator's detection that there is a correlation between the two images, i.e., the optical image from the optical sensor and an optical image representative of at least one of the markings.

Figure 1 shows an embodiment of the above head tracker system. This system, as set out in Appellant's independent claim 1, is for determining a user's head orientation relative to a fixed datum, and the position of the marking generators 18a-18j is known with respect to the fixed datum. The optical correlator correlates the image from the video camera 12 with an optical image representative of at least one of the markings, whether that marking be a cross, a circle or some other designation. The optical correlator compares the image scene in real-time with an image of the marking and if the marking generator image is contained within the video camera's image, a correlation indication is provided

along with the position of the marker image in the optical image from the video camera is known.

Appellant's specification at page 11, beginning at line 10, provides a detailed discussion of the interaction between the processor 28 (Appellant's "means for determining") and the correlator 26 ("optical correlator"). Because optical correlators are well known, as stated in Appellant's specification, their operation is not discussed in detail. However, a general discussion of their operation is set out in Appellant's specification beginning at page 11, line 10 through page 12, line 3. The optical processing permits an extremely fast dynamic response in determining whether a distinguishable marking is present in the video camera image, and if it is present, its relative position in the image. From this correlation information, the processor 28 can determine the orientation of the helmet 2 at the time the video image was captured.

Appellant's independent claim 1 specifies that the marking generators are in a fixed position with respect to a datum and that the video camera is in a fixed relationship to the head mounting. In this manner, movement of the head causes relative movement of the fixed marking generators through the view of the video camera, and such movement after optical correlation is discovered by the processor 28.

In another embodiment as discussed in Appellant's claim 2, there are a plurality of distinguishable markings which are fixed with respect to the helmet.

The optical sensor is located in a fixed relationship to the datum so that movement of the helmet causes movement of the distinguishing markings relative to the video camera 12, and again this relative movement is sensed and processed as discussed in claim 1.

Appellant's independent claim 15 is a further embodiment in which dedicated marker generators are not needed and the video camera is fixed relative to the head mounting and collects optical scene data representative of the user's embodiment. The optical correlator correlates the optical scene data taken by the video camera with optical scene data previously captured by the video camera to determine any change or relative movement of the head mounting between the capture of the optical scene data. This provides relative movement, i.e., movement between one optical image and another optical image, without the need for specific distinguishing markings.

Thus, Appellant's invention solves the problem of providing accurate head tracking systems for determining a user's head orientation relative to a datum by determining relative movement of marking generators in a video camera (whether the camera moves and the marking generators are fixed as in claim 1, or the camera is fixed and the marking generators move as in claim 2) or movement between two scenes (taken by the movable video camera mounted on the pilot's helmet as in claim 15). The relative movement in claims 1, 2 and 15 is determined

by an optical correlator and the output provided to a processor for determining the orientation of the pilot's head.

Appellant's invention is the recognition that the benefits of optical correlation, and in particular one embodiment uses the Vander Lugt optical correlator, to provide not only the desired high dynamic response, but also the high accuracy required of modern head tracking systems. Thus, the present invention is characterized by "**an optical correlator for optically correlating the optical image from the optical sensor with an optical image representative of at least one of said markings**" in claims 1 and 2 or "**an optical correlator for correlating said optical scene data with optical scene data previously captured by said optical sensor**" in claim 15.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-17 stand rejected under 35 USC §112 (first paragraph), with the specification allegedly failing to comply with the enablement requirement. The Examiner suggests that the lack of enablement is directed to the optical correlator and the processor. Specifically, the Examiner suggests that it is unclear to one of ordinary skill in the art how to replicate the invention with the provided disclosure.

Claims 1-4, 10-12, 15 and 17 stand rejected under 35 USC §102 as being anticipated by Hirota (U.S. Patent 6,064,749). The Examiner apparently contends that Hirota discloses each and every element set out in Appellant's independent

claims 1, 2 and 15, as well as each and every element set out in Appellant's dependent claims 3, 4, 10-12 and 17.

Claims 5-7 stand rejected under 35 USC §103 as unpatentable over Hirota in view of Teitel (U.S. Patent 5,812,257). The Examiner admits that Hirota fails to disclose a marking generator ("Hirota . . . does not disclose a marking generator . . . ."). However, the Examiner believes marking generators are taught by Teitel and, although not expressed in the rejection, suggests that it would be obvious to combine Hirota and Teitel.

Claim 16 is rejected under 35 USC §103 as unpatentable over Hirota in view of Symosek (U.S. Patent 5,424,556). The Examiner concludes that it would be obvious to combine Hirota and Symosek, without providing any reason or motivation for such combination.

VII. ARGUMENT

Appellant's arguments include the fact that there is no requirement under 35 USC §112 (first paragraph) that an applicant provide such a detailed disclosure so that anyone following that disclosure can practice the invention. Rather, the requirement under the first paragraph of §112 is to provide a disclosure sufficiently detailed so that one of ordinary skill in the art could practice the invention without undue experimentation.

Appellant's arguments include the fact that the burden is on the Examiner to demonstrate where at least one reference in an anticipation rejection teaches every claimed structure recited in Appellant's independent claims 1, 2 and 15.

Additionally, where the Examiner's rejection is dependent upon a combination of references, the burden is on the Examiner not only to demonstrate where the claimed structural elements are disclosed in one or more of the cited references, but it is also incumbent upon the Examiner to demonstrate how or why there is some reason or motivation to combine the references.

1. The originally filed specification clearly meets the requirements of 35 USC §112 and provides a more than sufficient disclosure to enable one of ordinary skill in the art to practice the invention

The Examiner suggests that "the specification lacks enablement with regards to the optical correlator and the processor." (Final Rejection page 2, section 4). Appellant's specification and Figure 1, provides a detailed disclosure of all elements and their interrelationship needed to practice several embodiments of the claimed invention. Specifically, these embodiments are discussed beginning on page 8, line 14 and carrying through to page 10, line 22. The discussion of the helmet 2, the video camera 12, the marking generators 18a-18j, the optical correlator 26 and the processor 28 are clearly disclosed and discussed.

Moreover, beginning on page 10, line 24, and continuing to page 12, line 3, there is a detailed discussion of the interrelationship between the optical correlator

and the processor, although Appellant's specification notes that "the operation of optical correlators is well known and accordingly their operation will not be discussed in detail." The Examiner has not traversed Appellant's statement that the operation of optical correlators is well known, and therefore there is no need for Appellant to submit documentation establishing this accepted fact.

Appellant's specification goes on and provides the detailed discussion in Figure 2 of how an optical correlator can take an image captured by a video camera and replayed by a spatial light modulator (spatial light modulators or SLMs are also well known as being LCD displays or digital micromirror projection devices and other devices) for projecting the image from the video camera and the processor's stored images.

As discussed in the specification, the video signals are encoded into a collimated laser beam generated by a laser diode and beam expander. The coherent optical images are transformed by the Fourier lenses 44 and 46. Since the images are coherent with respect to each other, they constructively interfere and provide a set of correlation peaks where spots of light indicate where the images are the same and the intensity shows how similar the images are. The set of correlation peaks is detected by a charge coupled diode or CCD camera 56 after they have been reverse transformed by additional Fourier lenses. The output of the camera 56 is used by the processor 28 to detect when one of the markings passes through the field of the view of the camera and thus provides the relative

positional information. Depending upon whether the camera is fixed or the markings are fixed, the relative position of the helmet is easily determined.

Appellant's specification also discusses in detail the embodiment of claim 15 in which an optical correlator is able to correlate a current scene from the video camera with scene data previously captured by the camera to determine relative movement of the head mounting during the interval between the capture of the two video scenes. This is discussed on page 13, beginning at line 7 and continued to the end of that page. Again, the optical correlation is the same process discussed earlier at page 11, line 10 through page 12, line 3, i.e. the Fourier transformed images are coherent with each other and they constructively interfere where they are the same, resulting in correlation peaks which are in the form of spots of light whose location indicates where the images are the same and whose intensity shows how similar the images are.

The pilot's helmet being directed at one portion of the cockpit for one image and then moving to another point in the cockpit for the second image will include portions of the cockpit which overlap, and those portions are identified as correlation peaks. The intensity of those peaks will be relatively high since portions of the images will be virtually identical. The position of the correlation peaks is detected and is an indication of the angular movement and/or rotation of the pilot's helmet in moving from the first position to the second position. Again, the processing and determining of this information is well known to those of

ordinary skill in the art, although Appellant's specification includes a relatively detailed discussion.

Thus, in accordance with the above, Appellant's specification clearly discloses more information than necessary for one having ordinary skill in the optical correlation art and the data processing art in order to practice the present invention with minimal, if any, experimentation. However, in order to be thorough, Appellant will respond to each of the points of argument set out by the Examiner in the Final Rejection which allegedly establish the Examiner's contention that the specification fails to comply with the enablement requirement.

(a) "It has not been shown how the input to the optical processor 12 becomes an optical image for optically correlating the optical image with an optical image representative of at least one of the markings."

Appellant's specification at page 11, lines 10-14, states "in operation the processor 28 has stored images (in the form of a video signal) which are representative of each of the distinguishable markings and it applies each of these sequentially to the reference SLM (spatial light modulator) 34 such that the correlator 26 optically correlates each frame captured by the video camera 12 with an image representative of each of the possible markings." Previously on page 11, lines 1-3, it is stated that the optical correlator comprises "an input spatial light modulator (SLM) 32 for inputting the image captured by the camera 12."

Quite clearly, video camera 12 provides an electronic signal which is then provided to a spatial light modulator so as to provide the same video image. This is nothing more than a conventional camcorder taking a video image of a scene and displaying that video image on the LCD color viewfinder, common in most home camcorders. Thus, where and how this is done is trivial and well known to those having ordinary skill in the art.

(b) "The means for determining the orientation of the head mounting using the output from the optical correlator when it detects there is a correlation between the images has not been disclosed."

As the Examiner apparently concedes, that which is discussed in the background of the invention, i.e., that "head tracker systems are well known and operate to determine a user's head orientation and position relative to a fixed datum" (Appellant's specification, page 1, lines 5-6) is known in the art. Thus, as Appellant has discussed on page 3, lines 5-21, the fact that existing tracking systems convert optical information into electronic information, and it is the electronic information which is conventionally compared to determine the pilot's head orientation and movement, is well known. The Examiner does not contend that this is anything above and beyond that which would be readily known by those of ordinary skill in the art.

What is new and unique about the present system is Appellant avoids the necessity to use electronic correlation and has been able to apply optical

correlation to maintain the desired level of accuracy and reduce the speed at which head tracking can be determined. Thus, the task of determining head mounting orientation from the data provided by the optical correlator output is again trivial and a minor application of the software conventionally used for electronic head tracking.

(c) "The application makes reference to the processor 28 having stored images, however it is unclear how the processor utilizes the output of CCD camera 56 and the stored images to determine movement and how the processor outputs an optical signal for use in the optical correlator 26."

The Examiner does not indicate where the reference is to processor 28 having stored images, but Appellant presumes this is a reference to page 11, line 10. Such stored images can be stored under a number of different storage formats, but it is clear that in view of Appellant's specification, the processor stores images representative of "each of the distinguishable markings." Appellant's discussion on page 11, lines 10-24 detail how the stored images of the distinguishable markings are sequentially compared to frames captured by the video camera 12.

If there is correlation between the two optical images, that is a clear indication that one of the distinguishable markings appears in the frame of the video camera and obviously from its position in the image, one can determine the position of the helmet mounted video camera. Again, while the operation of optical correlators is well known and is not contested by the Examiner, a detailed

discussion of how such comparison takes place and results in the movement information provided to the processor is set out in detail on page 11, line 10 through page 12, line 3.

The second question relates to how the processor outputs an optical signal for use in the optical correlator. As noted above, processor 28 has stored images which are representative of the distinguishable markings. As stated in the specification, these video signal (images) are applied to the SLM 34 so as to create a visible image and the correlator 26 correlates those stored images with the actual images provided by the video camera 12 (whose signal is applied to SLM 32), thereby creating an optical image.

The two images are joined and compared in the polarizing beamsplitters 36 and 38 with coherent collimated laser beam from laser diode 52. The Fourier lenses 48 and 50 convert information into correlation peaks which are detectable by the CCD camera 56. All of this is discussed on page 11, lines 10-24, and shown in Appellant's Figure 2. Again, while this optical correlator operation is well known, Appellant's specification includes the discussion.

(d) "It is unclear how the symbol generator 6 functions."

While symbol generator 6 is not claimed subject matter in the present application, the Examiner has been previously reminded that one beneficial application of a head tracker system is with respect to symbology displayed on a

helmet mounted display (HMD). Appellant's Figure 1 merely indicates how symbology can be provided to a helmet mounted display, especially when energized by processor 28.

Symbology which is dependent upon the user's head orientation, such as an artificial horizon, runway symbology, etc., it is desirable to have that symbology maintained its position relative to an actual view of the artificial horizon, runway, etc., regardless of helmet movement. Thus, it is necessary to generate the desired symbology, but that symbology generation does not form part of Appellant's invention. Because helmet mounted displays are well known in the field, the existence of symbol generators is well known and not a part of the present invention.

Inasmuch as the symbol generator is not part of Appellant's claimed invention, there is no obligation to provide an enabling disclosure of how to make and use such a symbol generator. However, even if there were such a requirement, Appellant contends that this is well known to those of ordinary skill in the art, as evidenced by the discussion in the background of the invention.

(e) "Lastly, reference numeral 10 in figure 1 has not been disclosed and could be an important element in the invention."

Appellant has previously pointed out to the Examiner in the Amendment filed May 17, 2004, page 12, that the Examiner is incorrect and reference numeral

10 is discussed on page 9, line 2 and is identified as being a "quick release connector arrangement 10 fixed inside the cockpit." Again, the existence or non-existence of any quick release connector arrangement is not a part of any of Appellant's claims and therefore whether or not it is sufficiently discussed is not relative to the enablement issue of Appellant's specification. Moreover, the existence of quick release connectors is well known and need not be disclosed in an application dealing with head tracker systems.

In view of the above, the Examiner has simply failed to raise any question which is not completely answered by Appellant's specification as originally filed. In fact, while Appellant has suggested that many of the structures recited in the claims are well known to those of ordinary skill in the art, Applicant has gone forward and provided a discussion of how those structures work, in particular the optical correlator and the data processor. Each specific application will vary and there is no requirement that Appellant's application contain blueprints or electrical circuit diagrams to explain how a video camera captures an image and then replays that image to a liquid crystal display device.

There is simply no requirement for the detail which might be necessary to explain the operation of the invention to one **not** having ordinary skill in the art. Appellant's specification clearly meets the test of teaching the practice of the current invention to those having ordinary skill in the art and any further rejection thereunder is respectfully traversed.

2. Claims 1-4, 10-12, 15 and 17 stand rejected under 35 USC §102 as being anticipated by Hirota (U.S. Patent 6,064,749)

The Examiner contends that the Hirota reference "an optical correlator (42) for optically correlating the optical image from the optical sensor (22) with an optical image representative of at least one of the markings" citing column 11, lines 30-50 of the Hirota reference. The Examiner is incorrect, in that he suggests that item 42 is "an optical correlator."

While Hirota identifies item 42 as "image analyzer 42" as described in Hirota, it is apparently searching for color characteristics in order to determine the existence of landmarks in an image. The Examiner provides no indication that the image analyzer 42 in Hirota comprises an optical correlator, as optical correlators are well known structures and comprise many of the elements discussed in association with the optical correlator in Appellant's specification.

Where is there any correlation, either electronic or optical, between images? It simply does not occur in the Hirota reference and the burden is on the Examiner to explain how or where Hirota teaches or suggests an optical correlator "for optically correlating the optical image from the optical sensor with an optical image representative of at least one of said markings." Again, the key is "optical" in the correlation process and not electronic, as electronic correlation has the problems and difficulties mentioned in Appellant's specification.

Thus, Hirota clearly fails to teach or suggest any aspect of Appellant's claimed invention, but in particular fails to contain any teaching of Appellant's claimed optical correlator.

3. Claims 5-7 stand rejected under 35 USC §103 as unpatentable over Hirota in view of Teitel (U.S. Patent 5,812,257)

The Examiner's admission that Hirota fails to disclose a marking generator is appreciated. Inasmuch as claims 5-7 depend from claim 1, the above comments distinguishing claim 1 over the Hirota reference are herein incorporated by reference, i.e., neither Hirota nor Teitel contain any disclosure of an optical correlator and therefore their combination cannot teach an optical correlator.

Each of Appellant's independent claims 1, 2 and 15 require an optical correlator and this is simply not present in either the Hirota or Teitel references. Therefore, claims 5-7, dependent from claim 1, cannot be obvious in view of Hirota, even if combined with Teitel.

Moreover, the Examiner has failed to provide any reason or motivation for combining the Hirota and Teitel references. The Court of Appeals for the Federal Circuit has consistently held that the burden is on the U.S. Patent Office to establish how or where there is some reason or motivation for combining references. Here, the Examiner is merely picking and choosing portions of prior art references, without any thought as to whether or why one of ordinary skill in the art would be motivated to combine them.

The Examiner has simply failed to establish any *prima facie* case of obviousness with respect to claims 5-7 and any further rejection thereunder is respectfully traversed.

4. Claim 16 stands rejected under 35 USC §103 as unpatentable over Hirota in combination with Symosek (U.S. Patent 5,424,556)

Claim 16 depends from claim 15 and the above comments distinguishing claim 15 from the Hirota reference are herein incorporated by reference. The Examiner has not alleged that the Symosek reference contains the optical correlator of claim 15 which, as noted above, is missing from the Hirota reference. If neither Hirota nor Symosek teach the missing optical correlator, the combination of these references cannot disclose or render obvious Appellant's claim 16 dependent on claim 15.

Additionally, even if there were a disclosure in one of these references of Appellant's claimed optical correlator, the burden is on the Examiner to establish where there is some reason or motivation for combining these references. This is simply missing from the Final Rejection and thus the Examiner has failed to make a *prima facie* case of obviousness.

VIII. CONCLUSION

Appellant has demonstrated that the present specification includes a sufficiently detailed discussion of data processors and optical correlators, as well

as their interconnection and interoperability such that one of ordinary skill in the art could easily procure and combine them in the manner of Appellant's invention. The standard of enablement set forth in 35 USC §112 is with respect to one of ordinary skill in the art, not a person having no skill in the art. Appellant's specification clearly meets all requirements of 35 USC §112.

With respect to the cited prior art references, none of the applied references contain any teaching of an optical correlator as set out in Appellant's independent claims 1, 2 and 15. Moreover, the Examiner has failed to point out how or where there is any reason for combining structures disclosed in the cited prior art references. There is simply no basis for a rejection under §102 or §103 of claims 1-17.

Thus, and in view of the above, the rejection of claims 1-17 under 35 USC §112, §102 and/or §103 is clearly in error and reversal thereof by this Honorable Board is respectfully requested.

Respectfully submitted,

NIXON & VANDERHYE P.C.

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SCS:kmm
Enclosures
Appendix A - Claims on Appeal

VIII. CLAIMS APPENDIX

1. A head tracker system for determining a user's head orientation relative to a datum comprising:

a head mounting for attachment to the user's head;

an optical sensor located in fixed relation with a known fixed point relative to the head mounting;

a plurality of distinguishable markings each of which is located in fixed relation with a respective known point which is fixed relative to the datum;

an optical correlator for optically correlating the optical image from the optical sensor with an optical image representative of at least one of said markings; and

means for determining the orientation of the head mounting responsive to an output from the optical correlator detecting that there is correlation between the images.

2. A head tracker system for determining a user's head orientation relative to a datum comprising:

a head mounting for attachment to the user's head;

a plurality of distinguishable markings each of which is located in fixed relation with a respective known point which is fixed relative to the head mounting;

an optical sensor located in fixed relation with a known fixed point relative to the datum;

an optical correlator for optically correlating the optical image from the optical sensor with an optical image representative of at least one of said markings; and

means for determining the orientation of the head mounting responsive to an output from the optical correlator detecting that there is correlation between the images.

3. A head tracker according to Claim 1, wherein said distinguishable marking comprises a spatial pattern.

4. A head tracker system according to Claim 1, wherein said distinguishable marking is defined in part at least by the colour of the marking.

5. A head tracker system according to Claim 1 and further comprising one or more marking generators for generating the distinguishable markings.

6. A head tracker system according to Claim 5 in which the colour of the markings is defined by the wavelength of the light produced by each marking generator.

7. A head tracker according to Claim 1 in which each marking is a substantially collimated image having an axis which is predetermined and which passes through said respective known fixed point.

8. A head tracker system according to Claim 1 in which the plurality of markings comprises features of the environment around the user.

9. A head tracker system according to Claim 1 in which the optical correlator is operable to sequentially, optically correlate the optical image from the optical sensor with an optical image representative of each of the markings.

10. A head tracker system according to Claim 1 in which the means for determining the orientation of the head mounting determines the head mounting orientation by determining where within the field of view of the optical sensor a marking is located.

11. A head tracker system according to Claim 1 in which the optical sensor comprises a video camera for capturing the optical image and producing an electrical signal representative of it and converting the electrical signal back to an optical image.

12. A head tracker system according to Claim 1 and further comprising a second optical sensor located at a second known fixed point relative to the head mounting or to the fixed datum.

13. A head tracker system according to Claim 1 in which the optical correlator is a Vander Lugt type correlator.

14. A head tracker system according to Claim 1 in which the optical correlator is of the joint transform type.

15. A head tracker system for determining a user's head orientation relative to a datum comprising:

a head mounting for attachment to the user's head;

an optical sensor located at a known point fixed relative to the head mounting and operable to collect optical scene data representative of the user's environment;

an optical correlator for correlating said optical scene data with optical scene data previously captured by said optical sensor to determine the relative movement of the head mounting between the capture of said optical scene data; and

means for determining the orientation of the head mounting from said relative movements.

16. A head tracker system according to Claim 15 wherein the environment comprises at least a part of an aircraft cockpit.

17. A head tracker system according to Claim 15 and further comprising providing one or more visibly distinguishable markings at respective known points which are fixed relative to the datum.